Door and window sill pan with drain

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RELATED APPLICATIONS

This application is related to and claims priority from US Provisional patent application No. 60/497,078 filed August 22, 2003, and US Provisional patent application No. 60/507,915 filed October 1, 2003.

FIELD OF INVENTION

This invention relates to a sill, sill pan flashing, sill pan, or sill pan flashing for a door or window, where the sill pan drains accumulated moisture.

BACKGROUND

It is desirable to provide a relatively low cost window and door sill pan with pan flashing for directional drainage of water and moisture which can be used for construction in all price ranges of housing, and for any door or window width. In one embodiment of the current invention, a base unit is provided which can be manufactured by extrusion and either cut to a desired length to fit the door or window width opening, or used with other similar elements and connectors to establish a desired final length. End pieces and optional center joining elements are provided for field assembly.

The prior art includes U.S. Patent No. 5,921,038 to Burroughs which describes a window sill pan with an inclined plate and ribs perpendicular to the front edge. The patent includes a front cover, but does not disclose end members.

U.S. Patent No. 6,385,925 B1 to Wark teaches an inclined plate with ribs perpendicular to the front edge. The Wark patent does not include a cover, but does have end members. Wark also describes the possible use of other window support means such as truncated cones. Wark describes the supports as being on the apparently solid inclined base.

It is desirable to provide a sill pan that can be used for doors or windows of any length. It is desirable to provide an economical sill pan device that can be used in most construction. One way to provide a relatively low cost device is to extrude the base. It is desirable in such applications to provide window or door supports which can be extruded in relatively long lengths suitable to be cut in the field in order to accommodate different size windows and doors. It is desirable to extrude a unit which includes door or window supports in order to avoid attaching separate support elements to a base unit.

It is desirable to manufacture window and door sill pan elements in an efficient and economical extrusion process, to supply the elements in relatively long lengths, and to cut the elements to a desired length at a construction site. This manufacturing and installation method may provide sill pans units that are more readily available to builders and which are more economical that purchasing prefabricated sizes from a supplier who is required to stock a large number of possible widths. This manufacturing and installation method eliminates the need for special ordering of sill pans for field dimensions.

Also, if an injection molding tool were required for each size, then relatively high volumes of each size would be required to pay for the tool. It is difficult to order and store many different sizes of sill pans for the variety of window and door dimensions

which are used in construction. By designing the sill pan for manufacture by extrusion, a single extrusion tool and a single injection molding tool for end pieces can provide sill pans of a variety of lengths. In some embodiments, sections of base may be connected to establish a desired length. In other embodiments, the base may be cut to a desired length.

SUMMARY

The current invention is for a window sill pan or door sill pan flashing. In some embodiments of the current invention, the device can be made in a low cost manufacturing operation by extrusion. In one embodiment, SureSill™ is made by combining extrusion and injection molding processes. The sill pan typically includes an inclined base, window or door supports which can be extruded as part of the base unit, and corner elements which can be snapped or otherwise attached to the base.

In some embodiments, the base may be solid. In other embodiments, the base may be hollow with window or door supports extending vertically through the base. In the case of fiberglass construction, the base may include a slanted upper face, but no lower face.

In one embodiment, the sill pan has offsets provided in both a rear sill pan wall and in a front flange. These offsets create a flow path for water to drain from the sill.

In one embodiment, the sill pan includes corner side flanges that are preferably provided without openings, and the sill pan is secured in a window or door opening by stapling across a corner of the side flange, by bending a nail over the flange, or by nailing through the flange.

In some embodiments, the window support means is provided in a horizontal orientation so that the base can be extruded. In other embodiments, the base may be fabricated from fiberglass, metal, or molded plastic, and may not have a horizontal orientation.

In other metal or plastic embodiments, the sill pan is provided as a center piece that can be cut to a desired length, and as end elements that can be snapped or glued to the center piece.

In one embodiment, an extruded base unit is cut to a desired length, and an installation tolerance is provided in corner units which slide onto the base unit.

In another embodiment, a base unit is provided in two or more sections which slidably overlap in a manner that compensates for rough framing tolerances.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention are set forth below and further made clear by reference to the drawings, wherein:

FIG. 1 is a top view of an embodiment of the invention

FIG. 2 is a side cross section view of the embodiment of FIG. 1.

FIG. 3 is a front view of the embodiment of FIG.1.

FIG. 4 is an exploded view of an embodiment with a base element and corner elements.

FIG. 5 is an enlarged detail perspective view of the right end element of the embodiment of FIG. 4.

FIG. 6 is a metal embodiment of the invention with a lateral additional central ridge.

FIG. 7A is a top view of a fiberglass embodiment of the invention.

FIG. 7B is a cross section view of the fiberglass embodiment of FIG. 7A.

FIG. 7C is a front view of a fiberglass embodiment of FIG. 7A.

FIG. 8 is an exploded view of an alternate embodiment with a base element and end elements.

FIG. 9 is an enlarged detail view of a right end element for the embodiment of FIG. 8.

FIG. 10 is a perspective view of a lock in channel base plate for the embodiment of FIG. 8.

FIG. 11 is a cross sectional view of the base element for the embodiment of FIG. 8.

FIG. 12A is a perspective view of a fiberglass sill pan embodiment.

FIG. 12B is a perspective view of a fiberglass sill pan embodiment.

FIG 13A is a top perspective view of an extruded sill pan section.

FIG 13B is a perspective view of the extruded sill pan section of FIG 13A with material removed in order to create a drain path.

FIG 14A is a top perspective views of another embodiment of an extruded sill pan section.

FIG 14B is a top perspective view of the extruded sill pan section of FIG 14A with a drain slot.

FIG. 15A is an exploded top perspective view of a sill pan base and corner units.

FIG. 15B is a top perspective view of the assembled base and corner units of the sill pan of the embodiment of FIG. 15A.

FIG. 15C is a top perspective view of an alternate embodiment of a right end element.

FIG. 16 is a detailed cross section view of the base of the embodiment of FIG. 15A.

FIG. 17A is a front perspective view of the right corner unit of the embodiment of FIG. 15A.

FIG. 17B is a rear perspective view of the right corner unit of the embodiment of FIG. 15A.

FIG. 17C is a bottom perspective view of the right corner unit of the embodiment of FIG. 15A.

FIG. 18A is a top perspective view of an assembled two-part sliding joint sill pan.

FIG. 18B is an exploded top perspective view of the two-part sliding joint sill pan of FIG. 18A.

FIG. 18C is a bottom perspective view of the two-part sliding joint sill pan of FIG. 18A.

FIG. 18D is a top perspective view of the second section of the two-part sliding joint sill pan of FIG. 18A

FIG. 18E is a bottom perspective view of the second section of the two-part sliding joint sill pan of FIG. 18A

FIG. 18F is a top perspective view of the first section of the two-part sliding joint sill pan of FIG. 18A

FIG. 18G is a bottom perspective view of the first section of the two-part sliding joint sill pan of FIG. 18A

FIG. 19A is a top perspective view of an assembled two-part sliding joint sill pan where the sections have been cut to a desired length.

FIG. 19B is an exploded top perspective view of the two-part sliding joint sill pan of FIG. 19A.

FIG. 19C is a bottom perspective view of the two-part sliding joint sill pan of FIG. 19A.

FIG. 20A is a top perspective view of an assembled two-part sliding joint sill pan with a cap section.

FIG. 20B is an exploded top perspective view of the two-part sliding joint sill pan of FIG. 20A

FIG. 20C is a bottom perspective view of the two-part sliding joint sill pan of FIG. 20A

FIG. 21A is a top perspective view of an assembled two-part sliding joint sill pan with a middle extension.

FIG. 21B is an exploded top perspective view of the sill pan of FIG. 21A.

FIG. 21C is a bottom perspective view of the sill pan of FIG. 21A.

FIG. 22A is a top perspective view of an alternate embodiment of the sill pan.

FIG. 22B is a bottom perspective view of the sill pan of FIG. 22A.

FIG. 23A is a top perspective view of an assembled adjustable sill pan.

FIG. 23B is an exploded top perspective view of the sill pan of FIG. 23A.

FIG. 23C is a bottom perspective view of the sill pan of FIG. 23A.

FIG. 23D is a top perspective view of a left corner element for the sill pan of FIG. 23A.

FIG. 23E is a bottom perspective view of the left corner element of FIG. 23D.

FIG. 23F is a top perspective view of a right corner element for the sill pan of FIG. 23A.

FIG. 23G is a bottom perspective view of the right corner element of FIG. 23F.

FIG. 23H is a top perspective view of a bottom element for the sill pan of FIG. 23A.

FIG. 23I is a bottom perspective view of the bottom element of FIG. 23H.

FIG. 23J is a bottom perspective view of a cap element for the sill pan of FIG. 23A.

FIG. 23K is a bottom perspective view of the cap element of FIG. 23J.

DETAILED DESCRIPTION OF EMBODIMENT- plastic sill pan with extruded base cut to desired length

Referring now to FIG. 1 which is a top view of a single sill pan, the sill pan includes a base **30** with a downwardly sloping top surface. The sill pan has a front support ridge **31** and a rear support ridge **32** for supporting a window or door. In this embodiment the sill pan includes an extruded middle piece **16,** or lock-in channel plate, and end pieces **15**, or, lock-in corners, which may be molded or provided by other manufacturing processes. Pieces are typically joined with cement such as PVC glue or with a snap together feature.

Referring now to FIG. 2 which is a side view of the sill pan embodiment of FIG. 1, the base **30** has a slope from the rear portion of the sill pan to the front portion The front support ridge **31** is solid through the base so that it rests on the bottom and the rear support ridge **32** is also solid, thereby transmitting the weight of the window or door to the support area for the sill. Wall thickness for the walls can be approximately 1/8 of an inch thick. In one embodiment the front support pedestal has a width of approximately ¾ of an inch, and the rear support pedestal has a width of approximately 1 inch.

As shown in the FIGs. 1 and 2, this embodiment includes a rear wall **25** and a downward extending lip **23**. The rear wall may include offsets (not shown) to provide a drain path between the rear wall and the window or door. The downward extending lip **23** may include an offset to provide a drain path between the sill pan and the siding or other materials installed around the window or door. These offsets create a drain path for moisture which might become present in the sill.

In this embodiment the front ridge may further include a gap **34** between the support ridge and the sides and may further include a drain channel **33** to permit the drainage of moisture. The corner pieces include a side upward lip **24** and a downward lip **23**.

Referring now to FIG. 3 which is a front view of the embodiment of FIG. 1, the front support ridge **31** includes gaps **33** and **34** for drainage.

FIG. 4 is an exploded view of an embodiment with a base element and end elements. In this case the extruded middle piece **16** includes a first channel **44** and a second channel **45**. The right corner element **15A** includes a first tab **46** which fits into the first channel **44**, and a second tab **47** which fits into the second channel **45**. The left corner element **15B** also includes a first tab **46** which fits into the first channel **44**, and a second tab **47** which fits into the second channel **45**. The tabs and channels create an interlocking between the middle piece and the corner elements.

FIG. 5 is an enlarged detail view of the right end element **15A** of the embodiment of Fig. 4. In this embodiment, the corner element includes a first tab **46** or alignment extension which may be inserted into the first channel **44** in the base portion; a second tab or alignment extension **47** may be inserted into the second channel **45** in the base portion; and an overlapping lip **42.**

DETAILED DESCRIPTION OF EMBODIMENT- method of manufacturing extruded base

It is desirable to provide a relatively low cost product which can be used for construction in all price ranges of housing. In one embodiment of the current invention, a

base unit is provided which can be manufactured by extrusion to a common long length, such as 16 feet, and cut to a desired length.

In this embodiment the base has longitudinal features, such as illustrated in FIGs 1 and 2, that can be extruded. For instance, the cross section of the base is consistent throughout the length so that the rear support is the same height throughout the length of the base, and the front support is the same height throughout the length of the base.

A drill or cut operation may be included to provide one or more drain slots in the support member front support so that water may drain from the sill pan.

End segments which are molded or otherwise produced may be attached to a desired length of base in order to provide a completed sill pan flashing unit.

DETAILED DESCRIPTION OF EMBODIMENT- metal sill pan

A metal sill pan or a plastic sill pan may be manufactured by extrusion as described above.

Referring now to FIG. 6, which is another metal embodiment of the invention, the sill pan may include a center support ridge **39** which includes drain-hole areas. In this example the sill pan is fabricated from a metal such as stainless steel. Other metals such as copper, lead, or aluminum may also be used.

The metal sill pan may also be produced by welding or otherwise securing the metal members.

DETAILED DESCRIPTION OF EMBODIMENT- sill pan with extruded base sections joined by connectors to form a desired length

In this embodiment the middle base may be constructed from two or more relatively short pieces which are joined by connector segments on one or both ends to achieve a desired length. In one connector embodiment, each end of the connector includes tabs such as **46** and **47** shown in FIGs 4 and 5. These tabs fit into channels **44** and **45** on the base unit segments. The sill pan also comprises end pieces which may be snapped onto or glued to the ends of the base unit.

DETAILED DESCRIPTION OF EMBODIMENT- fiberglass

In this embodiment, the door or window is supported by a rear support element and a front support element of a fiberglass sill pan.

FIG. 7A is a top view of a fiberglass sill pan which includes a rear support **32** and a front support **51** which tapers in plan toward drainage openings **52**. This taper directs water to the drainage openings. The drainage openings such as gaps, holes, or slots are typically provided at the ends of the front support, and may also be provided at one or more locations along the length of the support. Alternatively, weep holes may be provided in the front support. The weep holes may be formed as part of a molding operation in fiberglass or as a post extrusion process step for metal or plastic sills.

FIG. 7B is a cross section view of the fiberglass sill pan of FIG. 7A, and FIG. 7C is a front view of the sill pan. The rear wall may include a lip **53**, The front edge of the rear support **32** may be tapered for ease of manufacture. In this embodiment, the sill pan includes a sloping drain surface **54**. In this example, the fiberglass base does not have a solid surface on the bottom, and the front and rear support ridges extend to the bottom of

the sill pan, and no additional supports are required for the sloping drain surface **54**. If the sloping drain surface were load-bearing, then additional supports may be provided.

DETAILED DESCRIPTION OF EMBODIMENT- alternate fiberglass sill pan

FIGs. 12A and 12B are front perspective views of an alternate fiberglass sill pan. In this embodiment, the window or door is supported by a rear support **32** and a front support **31**. In this embodiment, the front support is not tapered as in the previous example. Drain slots **33** and **34** are provided in the front support in order to remove water from the sill pan.

DETAILED DESCRIPTION OF EMBODIMENT- extruded base with alternate interlocking end pieces

FIG. 8 is an exploded view of an alternate embodiment with a base element **16** and corner end elements **15A** and **15B**. In this embodiment, the end pieces are designed to fit over cut down portions to the front support **31** and rear support **32** and rear wall **25** so that the front and rear supports are essentially constant height across the assembled sill pan. In this embodiment, the base element **16** is typically produced by extrusion, and right and left end pieces **15A** and **15B** are typically molded, such as by injection molding.

Referring now to FIG. 9 which is an enlarged detail view of a right end element **15A** for the embodiment of FIG. 8, the end element includes a an overlapping lip **35** which fits over a portion of the right end of the base. The overlapping lip includes a rear portion which fits over a portion of the rear wall of the right end of the base, a rear support portion which fits over a portion of the rear support of the right end of the base, a

middle portion which fits over a portion of the right end of the base between the rear support and the front support, a front support portion which fits over a portion of the front support of the right end of the base, and a front lip portion which fits over a portion of the front lip of the right end of the base. Preferably, the overlapping lip overlaps the right end of the base in a manner that keeps the rear support and the front support substantially level across the sill. This end piece, also described as a lock-in corner, is preferably molded such as by injection molding, or vacuum forming.

Referring now to FIG. 10 which is a perspective view of a lock-in channel base plate **16** for the embodiment of FIG. 8, the right end of the base plate or lock in channel plate is preferably provided with incisions **61** on the front support plate **31**, on the rear ridge **32**, and on the rear upward lip **25**. In one embodiment, these incisions are prepared after cutting a standard length of extruded sill pan base, such as a 16 foot length, to a desired length. The incisions remove a portion of the right end of the front support plate **31**, the rear ridge **32**, and the rear upward lip **25** as shown in FIG 10. This removal may be accomplished by cutting a plastic or metal piece to the desired depth with a hacksaw or other cutting tool. In some cases, the cut material may be removed by a chisel. In other cases a special cutting tool may be provided.

Referring now to FIG. 11 which is a cross sectional view of the base element for the embodiment of FIG. 8, the base plate includes a keyed channel **50** for receiving a keyed profile **36** from the corner element. In some embodiments, the rear upward lip **25** may be extended downward or back and downward, to provide a surface that can be nailed or screwed into the window or door framing elements. The base preferably includes a plurality of channels that can be used to accept an excess of a sealant or

adhesive that may be used to set the window or door sill. Although it is desirable to provide a level window or door opening, in practice it is often difficult to achieve a level framing. In such cases, the sill pan may be set on an adhesive, such as PL 400 or PL Premium, by Osi Sealants, Inc.; or on a sealant such as NP1 by Sonneborn, by Chemrex.

In one embodiment, a window may be set into the sill pan and attached to the front ridge, by an adhesive. Drainage holes or slots in the front ridge are open, or will open, to direct the moisture to the outside.

DETAILED DESCRIPTION OF EMBODIMENT- extruded plastic base with UV resistance

In this embodiment, the base is extruded from a plastic such as PVC, polyvinyl chloride. The plastic includes ultraviolet light (UV) inhibitors that prevent the UV light from breaking down the plastic.

DETAILED DESCRIPTION OF EMBODIMENT- extrusion and cutting process

It is desirable to develop an extrusion process for plastic or metal sills. In some embodiments, door or window supports may be provided in a lateral orientation to permit the supports to be extruded. In an alternate embodiment, the base unit may be extruded as a solid piece and then post-processed with a cutting operation to remove material.

For example, the base plate can be extruded with no slope on the top surface **60** as illustrated in FIG 13A, so that the top surface is parallel with the bottom surface. After extrusion, the base plate can be inserted in a tool, such as punch press, saw, or combination, or device to make incisions in the top surface. In one embodiment, incisions

62, as shown in FIG 13B**,** have a downward slope towards the front of the sill pan, and may be perpendicular to the sill pan or at an angle with respect to the sill pan. For example, incisions can be 3" wide, and ½" apart. Incisions create drainage channels, and spaces between incisions create offsets to permit a drain path. Offsets typically have a coplanar surface and are used as support for installation of windows and doors.

In another post-extrusion processing example, an extrusion creates the middle piece or lock-in channel plate **16** as described in embodiments above. The top surface of the sill pan **30** is sloped toward the front of the sill pan. The extruded section has a front support ridge **31** and a rear support ridge **32** which are typically coplanar. One or more intermediate ridges may be provided between the front ad rear support ridge. After extrusion, this middle section **16** can be inserted in a tool, such as punch press or saw, or other device that makes cuts in the front and intermediate ridges in order for water to drain downwardly and outwardly through the ridges. The bottom of the incisions **63** as shown in FIG. 14B would have coplanar surface with the sloping top surface **30** of the lock-in channel plate. For example, incisions can be ½" wide, 12" apart. This embodiment shows example with perpendicular incisions on the front ridge, and other incision orientations are possible. In another embodiment, the auxiliary ridges may drain to the ends of the ridge, without additional drain slots in the middle of the ridges. This embodiment shows example with perpendicular incisions on the front ridge, and other incision orientations are possible.

DETAILED DESCRIPTION OF EMBODIMENT- extruded base with alternate interlocking end pieces

FIG. 15A is an exploded top perspective view of a base **300** which may be extruded and corner units **400** and **450** which are typically molded. The base includes a rear wall **310**, a rear support **320**, a base top surface **331** which may be sloped, a front support **330** with drain gaps **340,** and a front face **350**. In this embodiment, the drain gaps are preferably provided on 6" centers. FIG. 15B is a top perspective view of the assembled base **300** and corner units **400** and **450** of FIG. 15A. FIG. 15C is a top perspective view of an alternate embodiment of a right end element **450** which includes a nail slot **451** in the side flange **452**. In this embodiment, the nail slot has a height of about 0.13 inches.

FIG. 16 is a detailed cross section view of the base **300** of FIG. 15A. In this example, the front support **330** overlaps the front face **350**, and includes an inset rear face **332**. The rear support **320** includes recesses **322**, **323**, and **324** for engaging tabs from a corner element. In one example, the base has a depth of about 4.688", a front support width of about 0.722", a rear support width of about 0.989", and rear wall and front face thicknesses of about 0.94". In this embodiment the base top surface has a slope of about 1.7 degrees.

FIGs.17A and 17B are front and rear perspective views of a right corner unit **400** which includes a front face **440** and a side face **442**. In this example, the corner unit has several overlap features to snap or press fit with a base unit so that the sill pan can be assembled without glue or adhesive if desired. An overlap tab **410** is provided with a width selected to form a press fit between the front edge of the rear support **320** and the inset rear face **332** of the front support **330**. In this example, the tab has a convex front face **411** to fit with the inset rear face **332** of the front support. The width of tab **410** is

preferably slightly tapered on the end so that the fit becomes tighter as the corner is inserted on the base **300**. This tab has a top surface **412** that aligns with the top surfaces of the rear and front supports. In this example, the corner unit also includes a rear wall **430** and a lip **432** which overlap the base rear wall **310**, and a front inset portion **436** which overlaps the front face **350** and front end of the front support **330**.

FIG. 17C is a bottom perspective view of the right corner unit **400** which shows rear tabs **422**, **423**, and **424** which mate in the base section recesses **322**, **323**, and **324** respectively. These tabs are also preferably slightly tapered on the ends.

In this example, the left corner unit **450** is symmetrical to the right corner unit and includes similar tabs and overlap features.

This embodiment permits a sill pan base section to be cut to a desired length in the field for fitting a particular opening. The corner piece elements are then installed on the base section, and the assembled sill pan is placed on the bottom of the rough opening. The window or door is then installed on top of the sill pan and inside the rough opening.

DETAILED DESCRIPTION OF EMBODIMENT- adjustable sliding joint

In this embodiment, the sill pan comprises a first section which includes a first corner and a portion of the base, and a second section which includes a second corner and a portion of the base. These sections are designed to slide together without adhesive in a manner that provides for a framing tolerance of several inches. For wider openings a third center section is provided.

Each portion of base includes a lower part offset from an upper part. In one section, the upper part extends past the lower part, and in the other section the lower part

extends past the upper part. These extensions provide an installation tolerance. For instance, a typical 3' door requires a framed rough opening of 36 ½ " to 39". It is desirable to provide a sill pan which will fit into the opening regardless of the actual dimension of the rough framing.

FIG. 18A is a top perspective view of an assembled two-part sliding joint sill pan having a first section **100** which overlaps a portion of a second section **200**. In this example, the first section **100** includes a rear wall **110**, a rear support **120**, a sloped base top surface **130**, a front support **140** with drain gaps **142**, and a front face **150.** The first section also includes dams **170**, **171**, and **172**. The second section **200** includes a rear wall **210**, a rear support **220**, a front face **250**, and an end dam **270**. In this example, the first section includes a right corner, and the second section includes a left corner. The second section end dam **270** is snapped or glued between the rear support and the front support of the second section so that it retains accumulated water over the sloped base top surface **230** and directs that water to drain forward rather than toward the first section **100**.

FIG. 18B is an exploded top perspective view of the two-part sliding joint sill pan of FIG. 18A. In this embodiment, the second section **200** includes an end portion with ribs **260** which support the overlapping end of the first section. The support ridges **260** preferably have a downward slope toward the front of the sill. The support ridges **260** define base drain channels **262** for draining any moisture toward the front of the sill pan. The base channels **262** are preferably also sloped toward the front of the sill pan. The front end of the support ridges **260** overlap the front face **250** so that there is a drainage area provided between the front faces of the top part an bottom part**.** The end portion also

includes channels **264** and **265** for aligning with ribs **164** and **165** of the first section as shown in FIG. 18C which is a bottom perspective view of the assembled sill pan. The ribbed end portion of the second section extends 3" beyond the end dam **270**.

FIG. 18D is a top perspective view of the second section **200** showing details of the end dam **270**, the ribs **260**, drain channels **262**, and alignment channels **264** and **265.**

FIG. 18E is a bottom perspective view of the second section **200** showing a flat bottom surface **270**.

FIG. 18F is a top perspective view of the first section **100** showing details of dams **170**, **171**, and **172** which are preferably molded with the section.

FIG. 18G is a bottom perspective view of the first section **100** showing details of aligning ribs **164** and **165.**

FIG. 19A is a top perspective view of an assembled two-part sliding joint sill pan where the sections **100** and **200** have been cut to a desired length.

FIG. 19B is an exploded top perspective view of the two-part sliding joint sill pan of FIG. 19A which shows the first section **100** cut at a point past the dam **171** and the dam **170** (not shown). In this example, the end portion of the second section **200** has also been shortened. The shortened first section and the shortened second section are assembled as shown FIG. 19C which is a bottom perspective view of the assembled sill pan. In some cases it may not be necessary to cut either side, because the sliding joint feature will accommodate a range of lengths. In other cases, it is only necessary to cut one of the sections in order to create a sill pan with the desired length.

In this example, the top part extends **5"** beyond the top part. A typical minimum overlap between the first section and the second section is about **1 ½"**, so that the

working range of this embodiment has a range of about **6 ½"** in width. This working range may be utilized by increasing the overlap of the sections.

The top surfaces **130** and **230** of the first section and the second section may be continuously sloping. In other embodiments, the profile of the top surfaces of the sill pan may be flat in the rear and front and sloping in the middle. This variable profile may enhance the interlocking between the top part and the bottom part.

The top part and bottom part sections are typically fabricated separately, and the first section is inserted over the second section. The assembly may be glued in the factory, but is designed to be snapped together without adhesive in the field.

This embodiment may be fabricated from a plastic such as PVC or a metal such as aluminum. Parts can be made by injection molding, or blow-molding plastic/PVC, or aluminum casting, or with other materials and manufacturing methods.

This embodiment provides sliding joints to accommodate variations within a range of window or door size, and in rough opening size without cutting the sill. Alternately, the sill pan can be shortened in the field by cutting a portion from the mating end of each section.

Referring now to FIG. 20A and 20B which are top perspective assembled and exploded views of a sill pan, an optional cap section **280** may be installed over the exposed rib extensions of the second section.

In this embodiment, sill pans may include one or more additional middle sections such as shown in FIGs. 21A-21C. In this embodiment, each middle extension **180** has a first end, like the end of the first section, that slides over a ribbed extension; and a second end, like the end of the second section, which is a ribbed extension. Thus the sliding

joints in the middle section are like the sliding joint of the two-section embodiment. The sections are preferably joined by overlapping the ends without adhesive.

In this embodiment, the adjustable sill pan provides a drainable, sloped sill pan flashing for windows and doors, with a recessed slope for easy drainage and a horizontal mounting surface for windows and doors. The sliding joint design concept has a first one-piece left corner section, and a second one-piece right corner section. The first and second pieces partially slide into each other to provide an adjustable length sill pan. Additional middle extensions may be inserted to allow the sill pan to accommodate larger rough openings. The sliding joint design can accommodate a range of dimensions in window/door size, and in rough opening size, without cutting the pan. A further range of rough openings and standard sizes for windows and doors can be accommodated by cutting the portion of the sliding joint in the field. The sill pan can be assembled quickly without glue joints or adhesives, so that the installation can be performed regardless of temperature, under any weather conditions. The parts can be made out of injection molding, or blow-molding plastic/PVC, or aluminum casting, or other materials and manufacturing methods. The preferred minimum overlap is 1.5". In this embodiment, a portion of the second section is designed to slide underneath a portion of the first section, and has a recessed slope with perpendicular ribs, to channel any water that may accumulate in the joint, or on the lower section, to the exterior of the wall cavity. There are built-in dams on the upper surfaces of all sections to prevent water from upper surfaces from spilling to a lower portion. The upper portion of all sections has a recessed slope and longitudinal ridges for installation of windows and doors, with cuts in the front ridge for drainage.

DETAILED DESCRIPTION OF EMBODIMENT- slidable corner elements

FIGs. 23A-B are top perspective view of another embodiment of a slidably adjustable sill pan base. In this embodiment, a left corner element **630** and a right corner element **635** fit adjustably over a base element **600**. A cap element **640** may be inserted over the exposed base unit between the corner elements. FIG. 23C is a bottom perspective view od the assembled pan.

FIGs. 23D-E are top and perspective views of a left corner element for the sill pan of FIG. 23A. The corner element includes front and rear supports and a dam element as discussed in embodiments above. The corner element includes ribs **633** and **634** for aligning with corresponding channels in the base unit.

FIGs. 23F-G are top and perspective views of a right corner element for the sill pan of FIG. 23A. The corner element includes front and rear supports and a dam element as discussed in embodiments above. The corner element includes ribs **633** and **634** for aligning with corresponding channels in the base unit.

FIGs. 23H-I are top and perspective views of a base unit for the sill pan of FIG. 23A. The base unit includes a plurality of support ridges **610**. The support ridges define base drain channels **620** which are preferably sloped toward the front of the base unit in order to draining any moisture toward the front of the sill pan. The recessed surface between the support ridges may slope towards the front. In some embodiments, the support ridges may also slope to the front of the sill pan. The base unit also includes channels **631** and **632** for aligning with ribs **633** and **634** of the corner sections **630** and **635**.

In one embodiment, the base element is cut to a desired rough opening width after allowing for the corner sections. The base can be cut to rough opening size or slightly less.

In one embodiment, corner sections fit on top of the base unit, and no adjustment in the length of the base unit is needed due to corners. Corners should overlap the base sufficiently for the weight of windows and doors to be transferred to the structure. This assembly is easily accommodates thermal expansion or contraction of windows and doors and the wall structure, due to sliding joint design. The corner sections are then assembled on the base unit, and may be adjusted by sliding the corner sections along the ends of the base unit. The corners are preferably placed on ends of the base unit with the slide-in joint and without glue.

FIGs. 23J-K are top and perspective views of a cap element **640** for the sill pan of FIG. 23A. The corner element includes front and rear supports and dam elements as discussed in embodiments above. The cap element may be cut to length to fit between the corner pieces. The cap element may include ribs **633** and **634** to snap into the channels **631** and **632** of the base unit. In some embodiments, there may be more than one base section and more then one top plate assembling the unit. For example, base section and top plate could be manufactured in 38" lengths, and then either cut to smaller size to fit the opening or multiple pieces used for wider openings. The top plate should generally be the length of the base plate minus two corners that are installed on the base plate.

DETAILED DESCRIPTION OF EMBODIMENT- plastic sill pan with rear and front drainage channels

FIG. 22A which is a top perspective view of an alternate embodiment of the invention. In this embodiment, the sill pan has a base **500** which may have a downwardly sloping top surface or a relatively flat top surface. In the case of a relatively flat top surface, a portion of the moisture that collects on the base is dissipated by evaporation. In this embodiment, the sill pan has a plurality of ridge supports **510** that may be provided with a regular or an irregular spacing. Irregular spacing of the ridge supports permits more supports to be placed closer to the ends of the sill pan in areas that typically bear more of a door or window load than the central portions.

The sill pan includes a rear wall **520** which preferably includes offsets **522**. These offsets provide rear drainage channels **524** which permit moisture to drain from the rear of the window or door through the rear drainage channels into base drainage channels **514** formed between the support ridges **510.** The sill pan includes a front plate **530** which extends downward from the front edge of the base. The front plate preferably includes offsets **532**, which provide front drainage channels **534** for the base drainage channels **514**. The combination of the rear drainage channels, the base drainage channels, and the front drainage channels provides a continuous drain path for moisture which may accumulate on the sill.

Each end of the sill pan base **500** includes a side plate **550** which may include offsets **552** (not shown) to provide side drainage channels **554** (not shown) to the base. The offsets may be angled in order to provide bracing to a molded corner section, The end pieces preferably include a front plate **505** which extends above and below the base. The sill pan is typically secured to the framing by staples across the corners of the front plate **505**, or by bending a nail over the front plate **505**.

FIG. 22B which is a bottom perspective view of an alternate embodiment of the invention illustrates a flat base **560** for the sill pan.